



#16

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Richard J. Zeman and Joseph D. Etlinger  
Serial No. : 09/611,652  
Filed : July 7, 2000  
For : TREATING NEURAL CONDITIONS RESULTING FROM SPINAL  
CORD CONTUSIONS AND OTHER CAUSES  
Examiner : San-ming Hui  
Group Art Unit : 1617

DECLARATION OF SANSAR C. SHARMA, Ph.D. UNDER 37 C.F.R. 1.132

Commissioner for Patents  
Washington, D.C. 20231

Sir:

I, Sansar C. Sharma, Ph.D. declare that:

1. I received a Bachelor of Science degree in Biology from Panjab University in 1961 and a Ph.D. degree from University of Edinburgh Medical School in 1967.

2. I presently hold the position of Professor at New York Medical College. I have been a professor at New York Medical College since 1972.

3. My complete academic background, publications and professional experience are set forth in my Curriculum vitae, a copy of which is attached hereto as Exhibit A.

4. I have authored or co-authored more than 115 scientific articles in the area of animal physiology dealing with development and regeneration of the nervous system, of which 13 relate

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to treatments for muscular or spinal cord injuries or diseases.

5. I have reviewed the contents of this patent application, the pending claims, PCT Patent Publication WO99/09966 ("Etlinger et al."), and the Advisory Action dated February 4, 2003. I have reached certain conclusions regarding the Advisory Action based upon this review and my knowledge of the field of art and my experience.

6. I have read the statement at page 3 of the February 4, 2003 Advisory Action that asserts, "Since clenbuterol is known to treat scoliosis, one of ordinary skill in the art would be reasonably expected to employ clenbuterol in the treatment of spinal cord injury." This statement is contrary to what would be understood by an appropriately skilled physiologist for the following reasons.

7. Scoliosis or spinal curvature is a fundamentally different condition from that produced by spinal cord contusion injury. For this reason, the therapeutic treatments used for either of these conditions are also different. Spinal curvature is caused by unequal or asymmetrical muscular loading of the spine. A variety of neurological conditions that cause motor activity to be altered in muscles supporting local regions of the spine can result in scoliosis (6). For example, scoliosis can be produced by hereditary conditions in which motor inputs from the brain stem give rise to unequal contractile force that causes localized bending of the spine (2,10). Other causes of scoliosis include unilateral injuries to the spine or peripheral nerves and myopathic conditions such as muscular dystrophy (8,12,13,17). The method used by Etlinger to produce scoliosis involved a unilateral incomplete (3/4) transection of the spinal cord with a scalpel blade (7). This same procedure was originally used by Little and coworkers to demonstrate that the remaining intact portion on one side of the spinal cord was sufficient to support locomotor function (9). However, Etlinger discovered that the same procedure produces a local curvature of the spine in the region of the lesion that is eliminated by clenbuterol treatment. The resulting scoliosis is caused by local unequal loading of the spine, as is the case for scoliosis in general. Clenbuterol, which is known to increase muscle strength (1,4,11,14,18,19), can then act to support the spine by compensating for unequal spinal loading. Current treatment for scoliosis supports the spine by other means, i.e. internal or external bracing or electrical stimulation (6,15). Because the animals receiving 3/4 transection are not paralyzed and recover nearly complete locomotor function and walk without treatment (9), the effects of further treatment with clenbuterol or other means would be difficult to detect. Clenbuterol would also not alter the amount of spinal cord tissue transected, which is limited by the surgical procedure.



The ability of clenbuterol to promote locomotor recovery following contusion injury involves a different type of injury. The most common type of spinal cord injury is contusion injury, which is produced by a blunt trauma as in sports or automobile accidents (16). The bruising of the spinal cord that occurs following contusion is extensive and a considerably larger volume of tissue is mechanically disrupted and compressed compared to transection with a sharp instrument. In the studies of spinal cord contusion injury of Zeman and coworkers (20), treatment with clenbuterol spared spinal cord tissue by reducing the volume that would be lost to degeneration without treatment. The amount of sparing of contused spinal cord tissue by clenbuterol treatment was found to be directly related to the extent of locomotor recovery. This result indicates that clenbuterol can act directly on the contused spinal cord to produce locomotor recovery. The current and only treatment for spinal cord contusion injury is the steroid, methylprednisolone, an anti-inflammatory agent that can also spare spinal cord tissue (3,5).

The finding that clenbuterol can be used to treat both scoliosis and spinal cord contusion injury is due to multiple effects of the drug. By the well known ability of clenbuterol to increase muscle mass and strength (1,4,11,14,18,19), treatment with the drug can support the spine and improve the extent of spinal curvature. In contrast, by sparing spinal cord tissue following contusion, clenbuterol can be used to treat the resulting paralysis and loss of motor function. However, the effectiveness of clenbuterol in treating scoliosis resulting from spinal cord transection does not indicate that it would be effective in reducing tissue loss and paralysis resulting from contusion injury. The effectiveness of clenbuterol for treating spinal cord contusion injury can only be determined by directly demonstrating the ability of the drug to spare injured spinal cord tissue. For these reasons, the Etlinger publication (7) does not disclose a treatment for contusion injury of the spinal cord with a  $\beta_2$ -adrenoceptor agonist, but instead a treatment for scoliosis, i.e. curvature of the spine.

1. Agbenyega, E.T. and A.C. Wareham. Effect of clenbuterol on normal and denervated muscle growth and contractility. *Muscle & Nerve* 13:199-203, 1990.
2. Barrios, C., M.T. Tunon, J.A. DeSalis, J.L. Beguiristain and J. Canadell. Scoliosis induced by medullary damage: An experimental study in rabbits. *Spine* 12:433-439, 1987.
3. Behrmann, D.L., J.C. Bresnahan and M.S. Beattie. 1994. Modeling of acute spinal cord injury in the rat: neuroprotection and enhanced recovery with methylprednisolone, U-74006F and YM-14673. *Exp. Neurol.* 126:61-75.
4. Bowman, W.C. Effects of adrenergic activators and inhibitors on the skeletal muscles. In *Handbook of Experimental Pharmacology*, edited by L. Serkeres. Heidelberg: Springer-Verlag, 1980, vol. 54, p. 47-128.
5. Ducker, T.B. and Zeidman, S.M. Spinal Cord Injury: Role of Steroid Therapy. *Spine* 19:2281-2287 (1994).
6. D'Ambrosia, R.D., Ed. *Musculoskeletal Disorders: Regional Examination and Differential Diagnosis*. Philadelphia, PA, J.B. Lippincott Company, 1986, pp. 345-351.
7. Etlinger J.D. and R.J. Zeman. United States Patent 6,015,837 January 18, 2000 Method for treating scoliosis with beta<sub>2</sub>-adrenoceptor agonists. PCT Patent Publication (WO99/09966)



8. Galasko, C.S.B. and C.M. Delaney. Severity of scoliosis in patients with Duchenne Muscular Dystrophy at the time of referral to an orthopedic clinic. *Muscle & Nerve* 16:433-434, 1993.
9. Little, J.W., R.M. Harris and R.C. Sohlberg. Locomotor recovery following subtotal spinal cord lesions in a rat model. *Neuroscience Letters* 87:189-194, 1988.
10. Maguire, J., R. Madigan, S. Wallace, R. Leppanen and V. Draper. Intraoperative long-latency reflex activity in idiopathic scoliosis demonstrates abnormal central processing: A possible cause of idiopathic scoliosis. *Spine* 18:1621-1626, 1993.
11. Maltin, C.A., M.I. Delday, J.S. Watson, S.D. Heys, I.M. Nevison, I.K. Ritchie and P.H. Gibson. Clenbuterol, a  $\beta$ -adrenoceptor agonist, increases relative muscle strength in orthopaedic patients. *Clinical Science* 84:651-654, 1993.
12. Pincott, J.R., J.S. Davies and L.F. Taffs. Scoliosis caused by section of dorsal spinal nerve roots. *J. Bone Joint Surg.* 66B:27-29, 1984.
13. Pincott, J.R. and L.F. Taffs. Experimental Scoliosis in primates. *J. Bone Joint Surg.* 64B:503-507, 1982.
14. Reeds, P.J., S.M. Hay, P.M. Dorwood and R.M. Palmer. Stimulation of muscle growth by clenbuterol: Lack of effect on muscle protein biosynthesis. *Br. J. Nutrition* 56:249-258, 1986.
15. Schultz, A., K. Haderspeck and S. Takashima. Correction of scoliosis by muscle stimulation: Biomechanical analyses. *Spine* 6:468-476, 1981.
16. Schwab, M.E. and D. Bartholdi. Degeneration and Regeneration of axons in the lesioned spinal cord. *Physiol. Rev.* 76:319-370, 1996.
17. Suk, S.I., H.S. Song and C.K. Lee. Scoliosis induced by anterior and posterior rhizotomy. *Spine* 14:692-697, 1989.
18. Zeman, R.J., R. Ludemann, T.G. Easton and J.D. Etlinger. Slow to fast alterations in skeletal muscle fibers caused by clenbuterol, a  $\beta_2$ -receptor agonist. *Am. J. Physiol.* 254 (Endocrinol. Metab. 17):E726-E732, 1988.
19. Zeman, R.J., R. Ludemann and J.D. Etlinger. Clenbuterol, a  $\beta_2$ -agonist, retards atrophy in denervated muscles. *Am. J. Physiol.* 252 (Endocrinol. Metab. 15):E152-E155, 1987.
20. Zeman, R.J., Feng, Y., Peng, H. and Etlinger, J.D. Clenbuterol, a  $\beta_2$ -adrenoceptor agonist, improves locomotor and histological outcomes after spinal cord contusion in rats. *Exp. Neurol.* 159:267-273, 1999.

13. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



Signed,

Sansar C. Sharma

Sansar C. Sharma, Ph.D.

11<sup>th</sup> March 03.

Date





## CURRICULUM VITAE

NAME: Sansar C. Sharma  
MARITAL STATUS: Married  
CHILDREN: David (6/13/76) and Nina (4/14/79)  
DATE OF BIRTH: March 10, 1938  
HOME ADDRESS: 15 Engle Street  
Cresskill, NJ 07626  
HOME TELEPHONE: 201-567-2533  
OFFICE ADDRESS: Department of Ophthalmology  
New York Medical College  
Valhalla, NY 10595  
OFFICE TELEPHONE: 914-594-4382  
E-mail: sharma@nymc.edu  
SOCIAL SECURITY NO.: 500-58-6789

1. Education	Institution	From	To	Degree Conferral
a. Undergraduate	Panjab University Chandigarh, India	1959	1961	B.Sc. (Hons.)
b. Graduate	Panjab University Chandigarh, India	1961	1962	M.Sc. (Hons.)
c. Graduate	Univ. of Edinburgh Medical School Dept. of Physiology	1964	1967	Ph.D.
2. Postdoctoral Training		From	To	Position
a. Research fellowship	Univ. of Edinburgh Medical School Department of Physiology (Professor D. Whitteridge) (Professor Ainsley Iggo)	1967	1968	Research Fellow
b. Washington University	St. Louis, MO (Professor V. Hamburger) (Professor R. Levi-Montalcini)	1968	1970	Research Fellow
c. Washington University	(Professor V. Hamburger)	1970	1972	Research Assoc.

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### 3. Military - None

### 4. University Appointments

Institutions	From	To	Position
New York Medical College Dept. of Ophthalmology	1981	Present	Professor
New York Medical College Dept. of Cell Biology & Anatomy	1981	Present	Professor
NYMC Dept. of Neurology	1990	Present	Professor-Adjunct
NYMC Dept. of Ophthalmology (Tenured)	1977	1981	Assoc. Professor
NYMC Dept. of Anatomy	1978	1981	Assoc. Professor
NYMC Dept. of Ophthalmology	1972	1977	Asst. Professor
Univ. Medical School Edinburgh (Scotland) Dept. of Physiology	1966	1967	Teaching Assist.
D.A.V. College Ambala	1962	1963	Lecturer
Panjab University, Dept. of Zoology	1961	1962	Teaching Assist.

### 5. Hospital Appointments - None

### 6. Other Professional Position and Major Visiting Appointment

#### a. Visiting Professor,

Dept. of Neurobiology  
The Weizman Institute of Science  
Rehovot, Israel 1985

#### b. I.N.S.E.R.M. Fellow

Laboratoire d'Histologie Normale  
et Pathologique du Systeme Nerveux Suresnes  
Paris, France 1985

#### c. United Nations Develop Program

Visiting Fellow 1993

(i) National Institute of Mental Health and Neuroscience Bangalore, India-1993

(ii) All India University of Medical Science New Delhi - 1993

#### d. Visiting Professor,

Dept. of Neurobiology  
The Weizman Institute of Science  
Rehovot, Israel November 1993; January 1998

### 7. Academic Honors and Awards

Research Scholar of the Council for Scientific and Industrial Research, Panjab University, 1963-64

Research Scholar of the University Medical School (Physiology Dept.), Edinburgh, 1964-67

Summer Fellow, Marine Biological Laboratories, Woods Hole, MA, 1975

Research Career Development Award, National Institute of Health 1978-83

## **8. Major Committee Assignments**

### **a. International**

External Grant Reviewer for Medical Research Council of Great Britain and  
Canada, 1982-Present , Australian national research council  
External Reviewer for NATO Advanced Study Programs, 1988-1992

### **b. National and Regional**

External Grant Reviewer for NSF, 1976-Present  
NIH Special Study Section, 1978-1981  
NIH Special Study Section, 1986-1987  
NIH Study Section Vis. C., 1995-1997  
Member Scientific Advisory Council, Glaucoma Foundation, 1995-Present

### **c. Medical School**

Member of Accreditation Committee on Library and Graduate Education in the  
Sciences Basic to Medicine, 1979-1981  
Member of Tenure, Appointments and Promotions Committee, 1978-Present  
Member of Research Committee, 1979-1989  
Member Graduate Faculty Council, 1982-1986  
Graduate Program Director, Anatomy, 1983-1986  
Member Search Committee for Chairman of Neurology and Chairman of ENT., 1989-91  
Member Fellowship Review Committee, 1984-1990  
Member Committee on Innovation and Patent, 1986-1988  
Member Faculty Senate, 1991-Present  
Member Curriculum Subcommittee (1<sup>st</sup> and 2<sup>nd</sup> yr), 1991-Present  
Member Search Committee for the Chairman of Neurosurgery, 1996  
Member Curriculum Subcommittee (2<sup>nd</sup> and 3<sup>rd</sup> years), 1998-Present  
Member Education and Curriculum Committee, 1998-Present  
Member LCME Faculty Subcommittee, 1998-1999  
Member Student Financial Committee, 1998-Present

## **9. Editorial Boards**

1. Member - Journal of Neural Transplantation
2. Member - Journal of Visual Neuroscience

Editorial Boards - External Reviewer for:

1. Developmental Biology
2. Experimental Neurology
3. Experimental Eye Research
4. Brain Research (since 1977)
5. Journal of Anatomy
6. J. Neurobiology
7. Vision Research
8. Investigative Ophthalmology
9. Science
10. Journal of Comparative Neurology
11. Nature



## Editorial Boards - External Reviewer for: (continued)

12. Proceedings of the National Academy of Science
13. J. Neuroscience
14. Neuroscience
15. Development

## 10. Memberships, Offices in Professional Societies

Elected Fellow AAAS 1990  
American Physiological Society (FASEB)  
Society for Neurosciences  
Association for Research in Vision and Ophthalmology  
British Society of Developmental Biology  
New York Academy of Sciences  
American Association for the Advancement of Science  
Indian Association of Physiologists and Pharmacologists  
International Society for Developmental Neurobiologists  
European Neuroscience Society

## 11. Major Research Interests

Development of the visual pathways and the formation of neural topography; Neurobiology of axonal regeneration; Development and regeneration in the spinal cord; Ocular hypertension and changes in the retina.

## 12. Grant History

### a. Principal Investigator

Title of Research	Agency	Amount (Direct Cost)	From	To
Glaucoma Damage: Trophic Factors and Gene Therapy	NIH(NEI)	\$825,000	9/1/01	8/31/05
Glaucoma Damage: Trophic Factors and Gene Therapy	NIH (NEI)	\$605,000	12/8/95	12/7/99
Specificity in the Central Visual Pathways	NSF	180,000	9/1/92	8/30/95
Confocal Microscope - Instrument Grant	NIH	210,000	9/1/93	8/30/94
Genesis of Neural Specificity in the Visual System	NIH (NEI)	511,375	7/1/84	6/30/92
Genesis of Neural Specificity in the Visual System	NIH (NEI)	398,457	12/1/77	11/30/81
Genesis of Neural Specificity in the Visual System	NIH (NEI)	295,000	12/1/82	7/1/84
Formation of Visual Neuronal Connection- (Research Career Development Award)	NIH (NEI)	250,000	6/1/78	5/31/83
Regeneration in the Visual Pathways	NSF	70,000	6/1/74	8/31/77
Regeneration and Plasticity in the Visual System	Epileptic Research Foundation	25,000	6/1/73	5/30/75

**b. Co-Investigator**

Title of Research	Agency	Amount	From	To
Cell Death in Development (With Prof. V. Hamburger)	NIH	185,000	6/1/68	5/30/72

**c. Other Grants**

Advanced Study Institute on Organizing Principles of Neural Development	NATO	62,000	June, 1982
Development of the Nervous System in Vertebrates	NATO	78,000	July, 1992

**13. Major Teaching Experience**

Comparative Anatomy of Vertebrates and Invertebrates, D.A.V. College, Ambala  
Laboratories in Physiology, University Medical School Edinburgh, Scotland, 1964-1967  
Laboratories in Sensory Physiology, Washington University, St. Louis, MO, 1968-1972  
Anatomy and Physiology of the Eye, New York Medical College and New York Eye & Ear  
Infirmary, Residents in Ophthalmology, 1972-Present  
Medical Histology, New York Medical College, 1977-1989  
Medical Neurosciences, New York Medical College, 1977-Present  
Course Director Medical Neurosciences, 1990-Present  
Course Director Neuroscience (P.T.), 1995-Present  
Lectures in medical Embryology, New York Medical College, 1977-Present  
Graduate Course in Anatomy, 1977-Present

- a. Histology and Cell Biology
- b. Developmental Biology
- c. Seminars in Neurosciences
- d. Neuroanatomy
- e. Developmental Neurobiology (Course Director)

Lectures to Residences in Neurosurgery, Neurology and Surgery (Nervous System)

**14. Major Administrative Responsibilities**

Director of Graduate Program in Anatomy	1983-1986
Graduate School Executive Council	1981-1985
Tenure Appointment & Promotion Committee	1980-Present
Member Accreditation Committee on Library and Graduate Education in the Sciences Basic to Medicine	1979-1984
Search Committee for the Chairman of Neurology	1987-1988
Member Research Fellowship Review Committee	1984-1989
Member Committee on Innovation and Patent	1986-1988
Director Neural Sciences Medical School	1990-Present

## Students Trained

### a. Thesis advisor and/or committee examiner

1. Mark Eisenstadt. Development of spinal cord inputs in chick. 1969-72. M.Sc. degree 1972. M.D. 1975. Private practice, Boston.
2. David W. Kimm. Capillary reflex and neuropeptide aspects of parasympathetic ocular control. 1984. M.Sc. Thesis advisor.
3. Susan Baverman. Ph.D. (Thesis Advisor) Antigens associated with the regeneration of the optic nerve. 1988. Post. doc. in Immunology, New York Medical College.
4. Debra Marbey. Regeneration of the 8th nerve in turtles. 1985. Ph.D. Thesis. Examiner and member of the Committee. Case Western Reserve University, Assistant Professor.
5. Ellen Costello. M.Sc. (Thesis Advisor) Role of glucocorticoids in muscle atrophy. Assistant Professor, Cornell University, Ithaca, NY. 1988.
6. Theodore Scourles. 1987. M.Sc. Thesis Committee. A light microscope study of the spatiotemporal distribution of glycosaminoglycans in the early developing duck wing bud.
7. Richard Breckwoldt. M.Sc. 1984. The distribution of substance P like immunoactivity in the brain of goldfish. M.D. 1988-U.S. Navy.
8. Vera Asterade. 1986. Spinal cord regeneration in goldfish. M.Sc. Thesis advisor. Private practice.
9. Robert Bazzini. 1983. Early formation of Rathke's Pouch and the role of surrounding mesenchyme. Thesis committee. M.D. Private practice. New York City.
10. Arthur Weissmann. 1982. Spatiotemporal profile of the cat visual evoked responses during differential form discrimination. Ph.D. Thesis. NIH NINCDS staff member.
11. Ray Lo. Ph.D. 1981. Anatomical study of the choice of pathway by regenerating optic axons. McGill University (External Examiner). Assistant Professor, Anatomy-Calgary.
12. Steven Leber. 1984. Effect of delayed afferent arrivals on synapse localization on the Mauthner cells. Department of Neuroscience, Einstein College of Medicine. External Examiner. M.D. Ph.D. Thesis.
13. Claire Leonard. 1986. Ph.D. Limb development in chick biochemical aspects. Examiner. Presently Assistant Professor, Department of Medicine, New York Medical College.
14. Neil Smalhauser, M.D. Ph.D. 1978. Thesis Examiner. Pattern formation in the rat retinectal system in culture. Presently Assistant Professor, University of Chicago.
15. Michele Abercrombie. 1988. Ph.D. Thesis Examiner. The morphology and inductive activity of the apical ectodermal ridge: Influences of limb mesenchyme and subridge extracellular matrix. Presently M.D. student, New York Medical College.
16. Helen Badoyannis. 1990. Ph.D. Thesis Advisor. Regulation of catecholaminergic phenotypic expression of cell density and nerve growth factor in Pc12 cells.
17. Stefan Schlussman. 1993. Ph.D. Thesis Advisor. Retinal ganglion cells in normal and transgenic microphthalmic mice.
18. Enrique Garcia-Valenzuela. 1997. Ph.D. Degeneration of mammalian retinal ganglion cells following axonal lesion and gene transfer approach to their rescue.

### Two Ph.D. students presently working in the lab.

- ### b. Directed 12 week summer research program involving 1-2 medical students. Since 1974.

c. Post-Doctoral Fellows and Research Associates

Dr. Dean Yager, 1973-1974 - Research Associate

Dr. Martha Romeskie, 1976-1978, Research Associate; 1978-1980, N.I.H. Post-Doctoral Fellow 1F32-EY05220

Dr. Robert L. Tung, 1974-1976, Research Associate

Dr. Barry Grover, 1975-1977, Research Associate; 1977-1979, N.I.H. Post-Doctoral Fellow 1F32-EY05137

Dr. Steven Glasser, 1978-1980, Post-Doctoral Fellow

Dr. Ellen Lewis, 1980-1981, Post-Doctoral Fellow

Dr. P.D.P. Rao, 1981-1984, Research Associate

Dr. Sandra Fraley, 1981-1988, Research Associate

Dr. A.A. Dunn-Meynell, 1981-1986, Post-Doctoral Fellow

Dr. Lois Laemle, 1983-1984 (sabbatical leave from New Jersey College of Medicine and Dentistry, Newark, NJ)

Dr. K. Bhutiani, 1985, Fulbright Fellow from All India Institute of Medical Sciences, New Delhi

Dr. Viviana M. Berthoud, 1986-1987, Research Associate

Dr. D.M. Guthrie (on sabbatical leave from University of Manchester, England) 1987-1988

Dr. Eran Blaugrund, 1988, Visiting Scientist, Weismann Institute of Science Israel

Dr. DeMao Chen, 1988-1990, Research Associate

Dr. E. Vecino, 1989, Visiting Scientist, University Salamanca, Spain

Dr. Jin-Rong Liu, 1993-1995, Visiting Scientist, University of Peking Beijing, China

Dr. Priya Chaudhary, 1996-1999

Dr. Farid-Ahmed, 1996-1999

Dr. M.L. Lei, 1998-2000

Dr. Vimal Saurup 2001-present

Dr. Kiran Patel , 2001-present

15. Organizer National and International Meetings

- a. Directed and organized NATO advanced study institute "Organizing Principles for Neural Development", Povo de Varzin, Portugal, June 1-14, 1982.
- b. Organizer national meeting on ocular development "Cellular Communication during Development", Philadelphia, 1981.
- c. Director, NATO advanced study institute on the development of the nervous system, July, 1991.
- d. Director, international symposium on "Formation of Nerve Connection and Regeneration", Edinburgh Scotland , September, 1991.

## PUBLISHED PAPERS

- Tandon, K.K. and S.C. Sharma. Cytoarchitecture of the optic tectum of four cynprinoid fishes. Res. Bull. P.U. 14:119-126. 1964.
- Tandon, K.K. and S.C. Sharma. On the development and regeneration of optic fibers with return of vision in Danio rerio. Proc. Ind. Acad. Sci. 60: 287-292. 1964.
- Sharma, S.C. Cytoarchitecture of the optic tectum of blind rock pigeon Columbia livia. Res. Bull. P.U. 16:219-224. 1965.
- Gaze, R.M., M. Jacobson and S.C. Sharma. Visual responses from the goldfish brain following excision and reimplantation of the optic tectum. J. Physiol. (Lond.) 183:38-39. 1966.
- Cronly-Dillon, J.R. and S.C. Sharma. Effect of season and sex on the photopic spectral sensitivity of the three spined sticklebacks. J. Exp. Biol. 49:679-687. 1968.
- Gaze, R.M. and S.C. Sharma. Axial difference in the reinnervation of the goldfish tectum by regenerating optic nerve fibers. J. Physiol. (Lond.) 198:117. 1969.
- Gaze, R.M. and S.C. Sharma. Axial differences in the reinnervation of the goldfish tectum by regenerating optic nerve fibers. Exp. Brain. Res. 10:171-181. 1970.
- Sharma, S.C., R.R. Provine, T.T. Sandel and V. Hamburger. Unit activity in the isolated spinal cord of chick embryos. Proc. Nat. Acad. Sci. U.S. 66 (1):40-47. 1970.
- Provine, R.R., S.C. Sharma, T.T. Sandel and V. Hamburger. Electrical activity in the spinal cord of chick embryos in situ. Proc. Nat. Acad. Sci. U.S. 65:5-8-515. 1970.
- Sharma, S.C. and R.M. Gaze. The retinotopic organization of visual responses from tectal reimplants in adult goldfish. Arch. Ital. Biol. 109 (4): 357-366. 1969.
- Sharma, S.C. The retinal projection in the goldfish: An experimental study. Brain Research 39 (1):213-223. 1972.
- Sharma, S.C. The reformation of retinotectal projections after various tectal ablations in adult goldfish. Exp. Neur. 34 (1):171-182. 1972.
- Sharma, S.C. The restoration of the visual projection following tectal lesions in goldfish. Exp. Neur. 35:358-366. 1972.
- Sharma, S.C. Retinotectal connections of a heterotopic eye. Nature New Biology (Lond.) 238:286-287. 1972.
- Sharma, S.C. Redistribution of visual projection in altered optic tectum of goldfish. Proc. Nat. Acad. Sci. U.S. 69:2637-2639. 1972.
- Sharma, S.C. Anomalous retinal projections after removal of contra-lateral optic tectum in adult goldfish. Exp. Neur. 40:661-669. 1973

- Sharma, S.C. and J. Hollyfield. Specifications of the central retinal connections in Rana pipiens before the appearance of the first post-mitotic ganglion cells. *J. Comp. Neur.* 155:395-408. 1974.
- Sharma, S.C. Retinotectal specificity in adult goldfish. In Vision in Fishes - New Approaches in Research. Plenum Press, New York. Ed. M.A. Ali. pp. 145-150. 1975.
- Sharma, S.C. Development of the optic tectum in Salmo fario. In Vision in Fishes - New Approaches in Research. Plenum Press, New York. Ed. M.A. Ali. pp. 411-417. 1975.
- Sharma, S.C. Visual projections in surgically created "compound" tectum in adult goldfish. *Brain Research* 93:497-501. 1975.
- Yager, D. and S.C. Sharma. Evidence for visual function mediated by anomalous projections in goldfish. *Nature (London)* 256:5517. 1975.
- Edds, L.L. and S.C. Sharma. Retinotectal projection in the winter flounder (Pseudopleuronectes americanus). *J. Comp. Neur.* 173:307. 1977.
- Sharma, S.C. and M. Romeskie. Immediate compression in a tectum devoid of degenerating myelin. *Brain Research* 133:367-370. 1977.
- Yager, D., S.C. Sharma and B.G. Grover. Visual function in goldfish with unilateral and bilateral tectal ablation. *Brain Research* 137:267-278. 1977.
- Ingoglia, N.A. and S.C. Sharma. The effects of inhibition of axonal RNA transport on the restoration of retinotectal projections in regenerating optic nerves of goldfish. *Brain Research* 156:141-145. 1978.
- Sharma, S.C. and Y.L. Tung. Competition between nasal and temporal hemiretinal fibers in adult goldfish tectum. *Neuroscience* 4:113-119. 1979.
- Grover, B.G. and S.C. Sharma. Tectal projections in the goldfish (Carassius auratus): A degeneration study. *J. Comp. Neurol.* 184:435-454. 1979.
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